# MINERALOGICAL ABSTRACTS

## VOLUME 19

## 1968


Editor

R. A. HOWIE

Indexer and Assistant Editor

O. BRADLEY

Sub-Editors

DR. I. W. BLOXAM
DR. A. HALL
DR. C. M. B. HENDERSON
DR. C. H. KELSEY
DR. G. A. KINGSTON
DR. W. J. MCHARDY
DR. J. PHEMISTER
DR. J. N. WEBER

ORGANIZERS OF ABSTRACTS

*Great Britain :*

DR. R. A. HOWIE.
King's College.
Strand.
London, W.C.2.

*America :*

PROF. L. G. BERRY.
Queen's University.
Kingston.
Ontario.

*Australia :* DR. A. W. KLEEMAN, Geology Dept., University of Adelaide, South Australia.
DR. N. L. MARKHAM, School of Applied Geology, University of New South Wales.

*Austria :* PROF. HANS I. WIESENEDER, Mineralogisch-Petrographisches Institut, Universität Wien.

*Belgium :* DR. R. VAN TASSEL, Institut Royal des Sciences Naturelles, Brussels.

*Bulgaria :* PROF. Iv. KOSTOV, Chair of Mineralogy, University of Sofia.

*Czechoslovakia :* PROF. JIŘÍ NOVÁK, Charles University, Albertov 6, Prague 2.

*Denmark :* DR. HARRY MICHEELSEN, Mineralogisk Museum, Østervoldgade 7, Copenhagen.

*Egypt :* DR. E. M. EL SHAZLY, Geological Society of Egypt, 1 Elhamy St., Kasr El Doubara, Cairo.

*Finland :* DR. V. MARMO, Geological Survey, Otaniemi.

*Germany :* DR. ISA KUBACH, Joachim Becherstrasse 2, Frankfurt-am-Main.

*India :* DR. A. P. SUBRAMANIAM, Geological Survey of India, 3 Wanoree Bazar, Poona-1.

*Israel :* DR. DAN H. YAALON, The Hebrew University of Jerusalem.

*Italy :* PROF. EDOARDO SANERO, Instituto di Mineralogia e Petrografia, Universita di Genova.

*Japan :* DR. ICHIRO SUNAGAWA, Geological Survey of Japan, 8 Kawada-cho, Shinjuka, Tokyo.

*Netherlands :* DR. H. KONING, c/o Geological and Mineralogical Inst., Garenmarkt 1b, Leiden.

*New Zealand :* DR. W. A. WATTERS, Geological Survey, P.O. Box 368, Lower Hutt, North Island.

*Norway :* PROF. I. W. OFTEDAL, Institutt for Geologi, Universitetet, Oslo.

*Pakistan :* DR. F. A. SHAMS, University of the Punjab, Lahore, West Pakistan.

*Portugal :* DR. C. MATOS ALVES, Laboratório de Estudos Petrológicos e Palaeontológicos do Ultramar, Lisbon–1.

*South Africa :* PROF. E. S. W. SIMPSON, Dept. of Geology, University of Capetown, Rondebosch.

*Spain :* PROF. M. FONT-ALTABA, Dept. Cristalografía y Mineralogía, Universidad, Barcelona.

*Sweden :* PROF. SVEN HJELMQVIST, Mineralogisk-Geologiska Institution, Universitet, Lund.

*Switzerland :* PROF. DR. TH. HÜGI, Mineralog-Petrograph, Institut, Sahlistrasse 6, Bern.



PUBLISHED JOINTLY BY
THE MINERALOGICAL SOCIETY OF GREAT BRITAIN AND THE MINERALOGICAL SOCIETY OF AMERICA
LONDON—1969

# FOREWORD

The nineteenth volume of *Mineralogical Abstracts* contains 3,330 abstracts (including book notices). The abstracts are grouped in the sixteen main sections shown below ; the larger sections have been sub-divided as seems appropriate.

---

# CONTENTS



The Author index was compiled by J. Macqueen ; the Subject index by O. Bradley and E. M. Sheffield. Place-names are, in general, in the form used in the Columbia-Lippincott Gazetteer of the World (1952 edition) ; alternative forms are given on occasion.

Grateful thanks are due to those readers who have notified us of errors in volume 19 and earlier volumes of *Mineralogical Abstracts*.

# ORGANIZATION OF ABSTRACTS

Arising from a decision taken at the meeting of the INTERNATIONAL MINERALOGICAL ASSOCIATION in Copenhagen in 1961 the Mineralogical Societies of America and Great Britain agreed to issue a joint statement to National Societies adhering to the Association inviting each Society to organize contributions of abstracts of papers published in the journals of its country on subjects relevant to *Mineralogical Abstracts*. This invitation was issued and has brought a ratifying response. Members of Societies which have agreed to co-operate in this way are entitled to receive *Mineralogical Abstracts* for their personal use at a reduced rate of subscription in application *which must be made through their National Society*. The countries now co-operating include : AUSTRALIA, AUSTRIA, BELGIUM, BULGARIA, CANADA, CZECHOSLOVAKIA, DENMARK, EGYPT, FINLAND, GERMANY, INDIA, ISRAEL, ITALY, JAPAN, NETHERLANDS, NEW ZEALAND, NORWAY, PAKISTAN, PORTUGAL, SPAIN, SWEDEN, SWITZERLAND. Individual mineralogists and petrologists in countries not represented in the Association, or not yet co-operating through their National Society, provide abstracts from the literature of ARGENTINA, BRAZIL, KENYA, MEXICO, and SOUTH AFRICA.

# ABSTRACTORS

Contributors to this volume of *Mineralogical Abstracts* are :—

Adams, J. W. (J.W.A.), *U.S.A. ;* Agrell, J. E. (J.E.A.), *Gt. Britain ;* Alves, C. A. de Matos (M.A.), *Portugal ;* Andreasson, P. G. (P.G.A.), *Sweden ;* Arctic Institute of North America (A.I.N.A.), *U.S.A. ;* Atkins, F. B. (F.B.A.), *Gt. Britain ;* Ball, D. F. (D.F.B.), *Gt. Britain ;* Barker, F. (F.B.), *U.S.A. ;* Aires Barros, L. (L.A.B.), *Portugal ;* Bell, J. D. (J.D.B.), *Gt. Britain ;* Bibliography, Geol. Soc. America (G.S.A.Bib.), *U.S.A. ;* Bloxam, T. W. (T.W.B.), *Gt. Britain ;* Bodart, D. E. (D.E.B.), *Germany ;* Bradley, O. (O.B.), *Gt. Britain ;* Bryant, B. (B.B.), *U.S.A. ;* Bryhni, I. (I.B.), *Norway ;* Butler, B. C. M. (B.C.M.B.), *Gt. Britain ;* Chinner, G. A. (G.A.C.), *Gt. Britain ;* Chiplonkar, G. W. (G.W.C.), *India ;* Darmstadt, Min. Inst. (M.I.D.), *Germany ;* Desmukh, S. S. (S.S.D.), *India.*

Emeleus, C. H. (C.H.E.), *Gt. Britain ;* Fleischer, M. (M.F.), *U.S.A. ;* Forster, H. G. (H.G.F.), *Germany ;* Frost, M. J. (M.J.F.), *Gt. Britain ;* Frost, M. T. (M.T.F.), *Gt. Britain ;* Fruth, I. (I.F.), *Germany ;* Fuller, A. O. (A.O.F.), *South Africa ;* Garson, M. S. (M.S.G.), *Gt. Britain ;* Hall, A. (A.H.), *Gt. Britain ;* Hawley, C. C. (C.C.H.), *U.S.A. ;* Henderson, C. M. B. (C.M.B.H.), *Gt. Britain ;* Henderson, D. M. (D.M.H.), *U.S.A. ;* Henley, K. J. (K.J.H.), *Gt. Britain ;* Holdridge, D. A. (D.A.H.), *Gt. Britain ;* Howie, R. A. (R.A.H.), *Gt. Britain ;* Hügi, Th. (Th.H.), *Switzerland ;* Hytonen, K. (K.H.), *Finland.*

Japan, Min. Soc. (M.S.J.), *Japan ;* Kleeman, A. W. (A.W.K.), *Australia ;* Kleudgen, H. K. (H.K.K.), *Germany ;* Koning, H. (H.Ko.), *Netherlands ;* Kostov, I. (I.K.), *Austria ;* Lambert, R. StJ. (R.StJ.L.), *Gt. Britain ;* Lawson, R. I. (R.I.L.), *Gt. Britain ;* Le Bas, M. J. (M.J.LeB.), *Gt. Britain) ;* Lehijärvi, M. (M.L.), *Finland ;* Leonard, B. F. (B.F.L.), *U.S.A. ;* Lilljequist, R. (R.L.), *Sweden ;* Lipman, P. W. (P.W.L.), *U.S.A.*

McHardy, W. J. (W.McH.), *Gt. Britain ;* Marmo, V. (V.M.), *Finland ;* Mathias, F. C. M. (M.M.), *South Africa ;* Maxwell, J. A. (J.A.M.), *Canada ;* Meadows, A. J. (A.J.M.), *Gt. Britain ;* Mélo, E. B. de (E.B.M.), *Belgium ;* Mélon, J. (J.M.), *Belgium ;* Miesch, A. T. (A.T.M.), *U.S.A. ;* Mills, A. A. (A.A.M.), *Gt. Britain ;* Mitchell, R. S. (R.S.M.), *U.S.A. ;* Montoriol-Pous, J. (J.M.-P.), *Spain ;* Moorbath, S. (S.M.), *Gt. Britain ;* Morton, R. D. (R.D.M.), *Canada ;* Novák, J. (J.N.), *Czechoslovakia ;* Oftedal, I. W. (I.W.O.), *Norway ;* Olsen, E. (E.O.), *U.S.A. ;* Pabst, A. (A.P.), *U.S.A. ;* Phemister, J. (J.Ph.), *Gt. Britain.*

Raidt, H. (H.R.), *Germany ;* Rao, A. B. (A.B.R.), *Brazil ;* Reed, S. J. B. (S.J.B.R.), *Gt. Britain ;* Regnell, Ulla (U.R.), *Sweden ;* Richter, V. (W.R.), *Austria ;* Rost, F. (F.R.), *Germany ;* Rost, R. (R.R.), *Czechoslovakia ;* Rubin, M. (M.R.), *U.S.A. ;* Saalfeld, H. (H.Slf.), *Germany ;* Sanero, E. (E.S.), *Italy ;* Scharbert, H. G. (H.G.S.), *Austria ;* Seim, R. (R.S.), *Germany ;* Shams, F. A. (F.A.S.), *Pakistan ;* Smith, D. G. W. (D.G.W.S.), *Canada ;* Soles, J. A. (J.A.S.), *Canada ;* Stanfors, R. (R.St.), *Sweden ;* Stephenson, N. C. (N.C.S.), *Australia ;* Stewart, D. B. (D.B.S.), *U.S.A. ;* Strens, R. G. J. (R.G.J.S.), *Gt. Britain ;* Strunz, H. (H.S.), *Germany ;* Subramaniam, A. P. (A.P.S.), *India ;* Swanson, V. E. (V.E.S.), *U.S.A. ;* Taborszky, F. (F.T.), *Germany ;* Tell, Inge (I.T.), *Sweden ;* Tilling, R. I. (R.I.T.), *U.S.A. ;* Tomkeieff, S. I. (S.I.T.), *Gt. Britain ;* Töpper, W. (W.T.), *Germany ;* Toulmin, P., *III* (P.T.), *U.S.A. ;* Upton, B. G. J. (B.G.J.U.), *Gt. Britain.*

Vallance, T. G. (T.G.V.), *Australia ;* Van Tassel, R. (R.V.T.), *Belgium ;* Villiers, J. de (J.de V.), *South Africa ;* Vorma, A. (A.V.), *Finland ;* Walsh, J. N. (N.W.), *Gt. Britain ;* Ward, J. H. W. (J.H.W.W.), *South Africa ;* Watters, W. A. (W.A.W.), *New Zealand ;* Weber, J. N. (J.N.W.), *U.S.A. ;* Weibel, M. (M.W.), *Switzerland ;* White, W. A. (W.A.Wh.), *U.S.A. ;* Wilcox, R. E. (R.E.W.), *U.S.A. ;* Yaalon, D. H. (D.H.Y.), *Israel ;* Young, E. J. (E.J.Y.), *U.S.A. ;* Zimmerle, W. (W.Z.), *Germany ;* Zussman, J. (J.Z.), *Gt. Britain.*

# ERRATA AND ADDENDA

(L, R indicate left, right column ;
* indicates counted from bottom.)

*Mineralogical Abstracts*, vol. 8

| PAGE | LINE | |
|---|---|---|
| 194 | 1 | *for* Richardson *read* Richardton |

*Mineralogical Abstracts*, vol. 18

| | | |
|---|---|---|
| 118R | 9 | *for* SHASKINA *read* SHASHKINA |

*Mineralogical Abstracts*, vol. 19

| | | |
|---|---|---|
| 6L | 27 | for *titanites* read *titanates* |
| 22R | 21* | *for* Czeckoslovakian *read* Czechoslovakian |
| — | 28* | *for* Czeckoslovakia *read* Czechoslovakia |
| 37R | 3 | for *quaternären* read *Quaternären* |
| — | 6 | *for* Tertiary *read* Quaternary |
| 38R | 6 | for *les Cabesses* read *Las Cabesses* |
| 40R | 6* | *for* LiB, *read* Li, B, 40 |
| — | 9* | for *Sasyksivash* read *Sasyk-Sivash* |
| 45R | 8 | for *Mauretania* read *Mauritania* |
| 49R | 21* | *for* stipnomelane *read* stilpnomelane |
| 57L | 7 | *for* STECALCI *read* STECLACI |
| 61R | 13* | *for* tuffiite *read* tuffite |
| 63L | 12* | for *Granitoides* read *Granitoids* |
| 72R | 11 | for *Bara Mare* read *Baia Mare* |
| 79R | 28 | *for* rhodocrosite *read* rhodochrosite |
| 91R | 22 | for *Tshikawa* read *Ishikawa* |
| 99R | 3* | *for* Okayama *read* Okuyama |
| — | 8* | for *Okayama* read *Okuyama* |
| 101L | 29* | *for* berthlerite *read* berthierite |

*Mineralogical Abstracts*, vol. 19 (*contd.*)

| PAGE | LINE | |
|---|---|---|
| 125R | 4* | for *meta* read *metal* |
| 132L | 5 | *before* 1966 *insert* (Japanese with English summary), |
| — | 14 | *after* 0·02, insert $CO_2$ 2·01 |
| 148R | 18* | for *volano* read *volcano* |
| | 19* | for *Accomplex* read *A complex* |
| 152L | 7 | *for* Nigeria *read* Niger |
| 186R | 26 | *for* STEGLACI *read* STECLACI |
| 199R | 5 | *for* GIU,CA *read* GIUSCA |
| 207R | 8 | *for* TANNER, J. F. *read* TANNER, J. T. |
| 213L | 4* | *for* Nagoya *read* Nogoya |
| 235L | 27 | *for* soapstons *read* soapstone |
| 236R | 7* | for *Still* read *Sill* |
| — | 28* | *for* periodtite *read* peridotite |
| 237R | 8*, 9* | *for* microsctructures *read* microstructures |
| 243L | 11 | *for* SAVILL *read* SAVUL |
| 245R | 1 | for *Cristoblait* read *Cristobalit* |
| — | 28 | *for* ludgwigite *read* ludwigite |
| 248R | 3* | *for* Twining *read* Tsining |
| 259L | 13* | *for* CHUZO IIDI, TAMOTSU TANAKA, & KAZUO YAMASAKAI *read* IIDI, CHUZO, TANAKO, TAMOTSU, & YAMASAKAI, KAZUO |
| 262L | 25 | for *migmqtites* read migmatites |
| 272L | 15* | *for* VANCHÉ *read* VACHÉ |
| 280R | 23* | *for* Taymr *read* Taymyr |
| 287R | 19 | *for* CHELISHCHCHEV *read* CHELÍSHCHEV |
| 324R | 11 | *for* SOEN, OEN ING *read* OEN, ING SOEN |

# ABBREVIATIONS USED IN REFERENCE TO PUBLICATIONS

| | |
|---|---|
| Abhdl. | Abhandlungen |
| Abstr. | Abstract,-s |
| Abt. | Abteilung |
| Acad., Accad., Akad. | Academy, & *equiv.* |
| Adv. | Advancement |
| Agric. | Agricultur-al, -e |
| Anal. | Analy-st,-tical, &c. |
| Ann., An. | Annals, Anales, & *equiv.* |
| Anorg. | Anorganisch |
| Appl. | Applied |
| Arch. | Archives |
| Asoc., Assoc. | Association, & *equiv.* |
| Astron. | Astronomical |
| Bd. | Band |
| Beitr. | Beiträge |
| Ber. | Bericht-e |
| Berg. | Bergwesen |
| Bol., Boll., Bull. | Bulletin, & *equiv.* |
| Bur. | Bureau |
| Ceram. | Ceramic, & *equiv.* |
| Chem., Chim. | Chemi-cal,-stry, & *equiv.* |
| Cien. | Ciencia,-s |
| Circ. | Circular |
| Cl. | Classe |
| Com. | Comisión |
| Comm. | Commission |
| Conf. | Conference, & *equiv.* |
| Congr. | Congress, & *equiv.* |
| Contr. | Contributions |
| C.R. | Comptes Rendus |
| Crist., Cryst. | Crystallograph-ical,-y & *equiv.* |
| Dept. | Department, & *equiv.* |
| Diss. | Dissertation |
| Divn. | Division |
| Dokl. | Doklady=C.R. |
| Econ. | Economic |
| Educ. | Education |
| Eng. | Engineering |
| Exped. | Expedition |
| Exper. | Experimental |
| Expl. | Exploration |
| Fac. | Faculty |
| Fig(s). | Figure(s) |
| Fis. | Fisicale, fisico |
| Fören. | Föreningen |
| Förh. | Förhandlinger |
| Fortsch. | Fortschritt,-e |
| Gen. | General |
| Geol., géol. | Geolog-y, -ical, -ist, & *equiv.* |
| Gesell. | Gesellschaft |
| Geo-chem., chim. | Geochemi-cal, -stry, &c. |
| Geogr. | Geograph-y, ical, &c. |
| Geophys., geofis. | Geophysic-al, -s, &c. |
| Govt. | Government |
| Hdbh. | Handbuch |
| Illustr. | Illustrat-ed, -ions |
| Imp. | Imperial |
| Industr. | Industr-ial, -y |
| Inform. | Information |
| Inst. | Institute, institution, & *equiv.* |
| Instr. | Instruments |
| Int. | Interior |
| Intern. | International |
| Invest. | Investigations |
| Issl. | Issledovaniye=investigation |
| Ist. | Istituto |
| Izd. | Izdanie=publication |
| Izvest. | Izvestiya |
| Jahresb. | Jahresbericht |
| Jahrb. | Jahrbuch |
| Jorn., Journ. | Journal, & *equiv.* |
| Khim. | Khim-ie, &c. |
| Kl. | Klasse |
| Krist. | Kristallographie, &c. |
| Lab. | Laboratory |
| Lit. | Literary |
| Mag. | Magazine |
| Mat., Math. | Mathematical, & *equiv.* |
| Medd. | Meddelelser |
| Mem., Mem. | Memoir, -s, & *equiv.* |
| Metall. | Metallurg-ical, -y |
| Min. | Mineralog-ical, ist, -y |
| Misc. | Miscellaneous |
| Mitt. | Mitteilungen |
| Mh. | Monatsheft |
| Mus., Muz. | Museum, & *equiv.* |
| Nac., Nat. Naz. | National, & *equiv.* |
| Natur. | Natur-al, -alist, & *equiv.* |
| Natur-w, -v | Naturwissenschaft, & *equiv.* |
| Obraz. | Obrazovanie=education |
| Obshch. | Obshchestva=society |
| Petr. | Petrolog-ical, -y, & *equiv.* |
| Petrol. | Petroleum |
| Phil. | Philosophical, &c. |
| Photos. | Photographs. |
| Photomicros. | Photomicrographs |
| Phys. | Physic-al, -s, & *equiv.* |
| Pl(s). | Plate(s) |
| Polytech. | Polytechnic, & *equiv.* |
| Pract., Prakt. | Practical, & *equiv.* |
| Proc. | Proceedings |
| Prof. | Professional |
| Prosp. | Prospecting |
| Publ. | Publication(s), published |
| Rasv. | Razvedka=survey |
| Rec. | Records |
| Ref. | References, referata |
| Rend. | Rendiconti |
| Repb. | Republic |
| Rept. | Report(s) |
| Res. | Research |
| Reserv. | Reserves |
| Resrcs. | Resources |
| Rdsch. | Rundschau |
| Rev. | Review |
| Roy. | Royal, & *equiv.* |
| Sborn. | Sbornik=magazine |
| Sch. | School, Schule |
| Sci. | Science |
| Sect. | Section |
| Sedim. | Sedimentary |
| Ser., ser. | Series, & *equiv.* |
| Serv. | Service |
| Sitzb. | Sitzungsbericht |
| Skr. | Skrift, -en, -er |
| Soc. | Society, & *equiv.* |
| Sondbd. | Sonderband |
| Spec., spez. | Special, & *equiv.* |
| Stand. | Standard(s) |
| Stn. | Station |
| Suppl. | Supplement |
| Surv. | Survey, -or |
| Symp. | Symposium |
| Tab(s). | Table(s), tabellen |
| Techn. | Technolog-ical, -y |
| Tids(s)kr. | Tids(s)krift, -en |
| Tijdschr. | Tijdschrift |
| Trab. | Trabajos |
| Trans. | Transactions |
| Transl. | Translat-ed, -ion |
| U.A.R. | United Arab Republic |
| Uch. | Uchennye=learned |
| Ucheb. | Uchebnyi=teaching |
| Unders. | Undersögelse, undersökning |
| Univ. | University, & *equiv.* |
| Verhdl. | Verhandlungen |
| Vidensk. | Videnskaps |
| Volc., Vulk. | Volcanolog-ical, -y, &c. |
| Vses. | Vsesoyuznyi=All-Union |
| Vyssh. | Vysshikh=higher |
| Wiss. | Wissenschaft |
| Zap. | Zapiski=memoirs |
| Zav. | Zavodskaya=factory |
| Zaved. | Zavedenii=institution |
| Zeits. | Zeitschrift |
| Zhurn. | Zhurnal=journal |
| Ztg. | Zeitung |

# ABBREVIATIONS AND SYMBOLS

used in the text of abstracts

M.M. ... Mineralogical Magazine : M.A. ... Mineralogical Abstracts : A.M. ... American Mineralogist

## CHEMICAL & CHEMICAL-PHYSICAL

| | |
|---|---|
| cation-exchange-capacity... ... ... | c.e.c. |
| chemical analysis ... ... ... ... | chem. anal. |
| concentrated ... ... ... ... | conc. |
| differential thermal analysis ... ... | d.t.a. |
| dilute ... ... ... ... ... | dil. |
| equivalent $U_3O_8$ ... ... ... ... | e$U_3O_8$ |
| ethylenediaminetetra-acetic acid ... | EDTA |
| heat of formation (absolute temperature subscript) ... ... ... ... | $\Delta H_t$ |
| hydrogen ion conc., acidity ... ... | pH |
| insoluble residue ... ... ... ... | insol. res. |
| isotopes, e.g. ... ... ... ... | $^{40}Ar$, $^{40}K$ |
| loss on ignition ... ... ... ... | ign. loss |
| milliequivalent ... ... ... ... | me. |
| microgramme ... ... ... ... | $\mu g$ |
| million-years ... ... ... ... | m.y. |
| not determined ... ... ... ... | n.d. |
| not found ... ... ... ... | nt. fd. |
| not present ... ... ... ... | nil |
| parts per million ... ... ... ... | p.p.m. |
| rare earths ... ... ... ... ... | *TR* or *RE* |
| strength of solution, normal ... ... | *N* |
| — — — molar ... ... | *M* |
| substances in ionic state | |
| anions, e.g. ... ... ... ... | $Cl^-$, $SO_4^{2-}$ |
| cations, e.g. ... ... ... ... | $K^+$, $Fe^{3+}$ |
| thermogravimetric analysis ... ... | t.g.a. |
| trace ... ... ... ... ... | tr. |

## CRYSTALLOGRAPHIC & STRUCTURAL

| | |
|---|---|
| Ångstrom unit ($10^{-8}$ cm) ... ... | Å |
| crystal axes ... ... ... ... | *a*, *b*, *c* |
| — face indices ... ... ... | (hkl) |
| — form indices ... ... ... | {hkl} |
| — zone indices ... ... ... | [hkl] |
| indices of X-ray diffractions ... ... | hkl |
| intensity, ... ... ... ... ... | *I* |
| — relative ... ... ... | $I/I_0$ |
| interplanar spacing ... ... ... | *d* |
| mica structural polymorphs ... ... | $1M_1$, $2M_1$ |
| Siegbahn units ... ... ... ... | kX |
| space group. These words will be written in full | |
| unit cell, formula units ... ... ... | *Z* |
| — — repeat distances ... ... | *a*, *b*, *c* |
| — — reciprocal lattice lengths of edges ... ... ... ... | $a^*$, $b^*$, $c^*$ |
| — — interaxial angles direct lattice ... | $\alpha$, $\beta$, $\gamma$ |
| — — — — reciprocal lattice ... | $\alpha^*$, $\beta^*$, $\gamma^*$ |

## OPTICAL

| | |
|---|---|
| dispersion, e.g. ... ... ... ... | $r > v$ |
| extinction angle, e.g. ... ... ... | $\gamma : c$ |
| infrared ... ... ... ... ... | IR |
| optic axial angle ... ... ... ... | 2V |
| — — plane ... ... ... ... | O.A.P. |
| refractive index, in text ... ... ... | refr. ind. |
| — — of isotropic mineral ... | *n* |
| refractive indices | |
| of uniaxial mineral ... ... ... | $\omega$, $\epsilon$ |
| of biaxial mineral ... ... ... | $\alpha$, $\beta$, $\gamma$ |
| sign of biaxiality | |
| negative ... ... ... ... | $2V_\alpha$ or — |
| positive ... ... ... ... | $2V_\gamma$ or + |
| ultraviolet ... ... ... ... ... | UV |

## PHYSICAL

| | |
|---|---|
| calculated ... ... ... ... ... | calc. |
| calorie ... ... ... ... ... | cal. |
| calorie, large ... ... ... ... | kcal. |
| cycles per second ... ... ... ... | c/s |
| degree centigrade ... ... ... | °C |
| density ... ... ... ... ... | *D* (quote units) |
| — , relative, e.g. ... ... ... | $D_4^{20}$ |
| gramme ... ... ... ... ... | g |
| hardness ... ... ... ... ... | H. |
| melting-point ... ... ... ... | m.p. |
| micron ($10^{-4}$ cm) ... ... ... ... | $\mu$ |
| millimicron ($10^{-7}$ cm) ... ... ... | m$\mu$ |
| pounds per square inch ... ... ... | lb/in.$^2$ |
| pressure ... ... ... ... ... | *P* |
| soluble ... ... ... ... ... | sol. |
| specific gravity, terms of reference not known ... ... ... ... ... | sp. gr. |
| temperature ... ... ... ... | *T* |
| Vickers hardness number ... ... | VHN |
| wavelength ... ... ... ... | $\lambda$ |

## SYMBOLS

| | |
|---|---|
| approximately equal to ... ... ... | $\sim$ |
| equal to ... ... ... ... ... | $=$ |
| equal to or greater than ... ... ... | $\geqslant$ |
| equal to or less than ... ... ... | $\leqslant$ |
| greater than ... ... ... ... | $>$ |
| less than ... ... ... ... ... | $<$ |
| not equal to ... ... ... ... | $\neq$ |
| parallel to ... ... ... ... ... | $\parallel$ |
| per cent. ... ... ... ... ... | % |
| per mille ... ... ... ... ... | ‰ |
| perpendicular to ... ... ... ... | $\perp$ |
| proportional to ... ... ... ... | $\propto$ |